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Review Article

Therapeutic Dancing for Parkinson's Disease☆

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SUMMARY

Therapeutic dancing has been advocated as an effective adjunct to conventional physical therapies for people living with Parkinson's disease (PD). This systematic review evaluates studies on the outcomes of different dance genres on mobility and quality of life in PD. We searched databases including CINHAL (1982–2015), Medline (1922–2015), Scopus (1996–2015), Web of Science (2002–2015), Embase (2007–2015), PEDro (1999–2015) and the Cochrane Library (1996–2015). The key words were: *Parkinson's disease*, *Parkinson**, *Parkinsonism*, *dance*, *dance therapy*, *dance genres*, *safety*, *feasibility*, and *quality of life*. Two independent investigators reviewed the texts. Only randomized controlled trials, quasirandomized controlled trials, and case series studies were included. There was emerging evidence that therapeutic dance can be safe and feasible for people with mild to moderately severe PD, with beneficial effects on walking, freezing of gait, and health related quality of life.

1. Introduction

This systematic review critiques recent studies on the effects of different dance genres on mobility, gait, balance, and quality of life in people living with idiopathic Parkinson's disease (PD). We also evaluated participant satisfaction with therapeutic dancing classes as well as the feasibility and safety of dancing as a form of therapy.

People with PD experience movement disorders such as bradykinesia, tremor, rigidity, and postural instability, which vary over time and between individuals[1]. Nonmotor symptoms such as cognitive impairment, autonomic dysfunction, and anxiety are also features. PD can sometimes be associated with depression and withdrawal from participation in social activities[1].

Several studies have shown conventional physiotherapy to have short-term benefits for gait, postural stability, mobility, and quality of life in some individuals with PD[2–5]. Nevertheless, compliance and adherence with physiotherapy and routine exercises can be challenging over the long term[4,6]. Other forms of physical activity such as cycling, walking, hydrotherapy, and martial arts could be helpful adjuncts to traditional therapy[2,5,7–10]. Evidence is emerging that dancing can be a beneficial form of exercise for people with mild to moderately severe PD[6,11,12]. As well as being a highly social and engaging physical activity, it has the potential to increase body awareness, wellbeing, and movement control through the use of cueing, cognitive strategies, creativity, and music[13–15].

Although dancing for PD is becoming popular, the optimal elements of dance to enhance therapy outcomes remain unclear. There is a need to examine the extent to which outcomes are influenced by factors such as external cues, music, partners, and motivation imparted from a dancing teacher[11]. The long-term effects of therapeutic dancing have not been confirmed[16].

A recent PD review by Shanahan et al[11] showed that the dosage, genre, frequency, and intensity of dancing classes are associated with changes in mobility, balance, and motor impairment. The current study updates and extends that line of enquiry to quantify the safety and feasibility of PD dance classes. It also includes outcome variables such as freezing of gait, walking performance, quality of life, and wellbeing.

2. Methods

2.1. Data sources and searches

Articles had to be published in English, evaluate the effects of dance therapy, describe outcome measurements, and provide data on the feasibility, safety and the efficacy of dancing for PD. Books, theses, and conference abstracts were excluded. Only randomized controlled trials (RCTs), quasi-RCTs (QRCTs), and case series were included. Participants needed to be older than 18 years, male or

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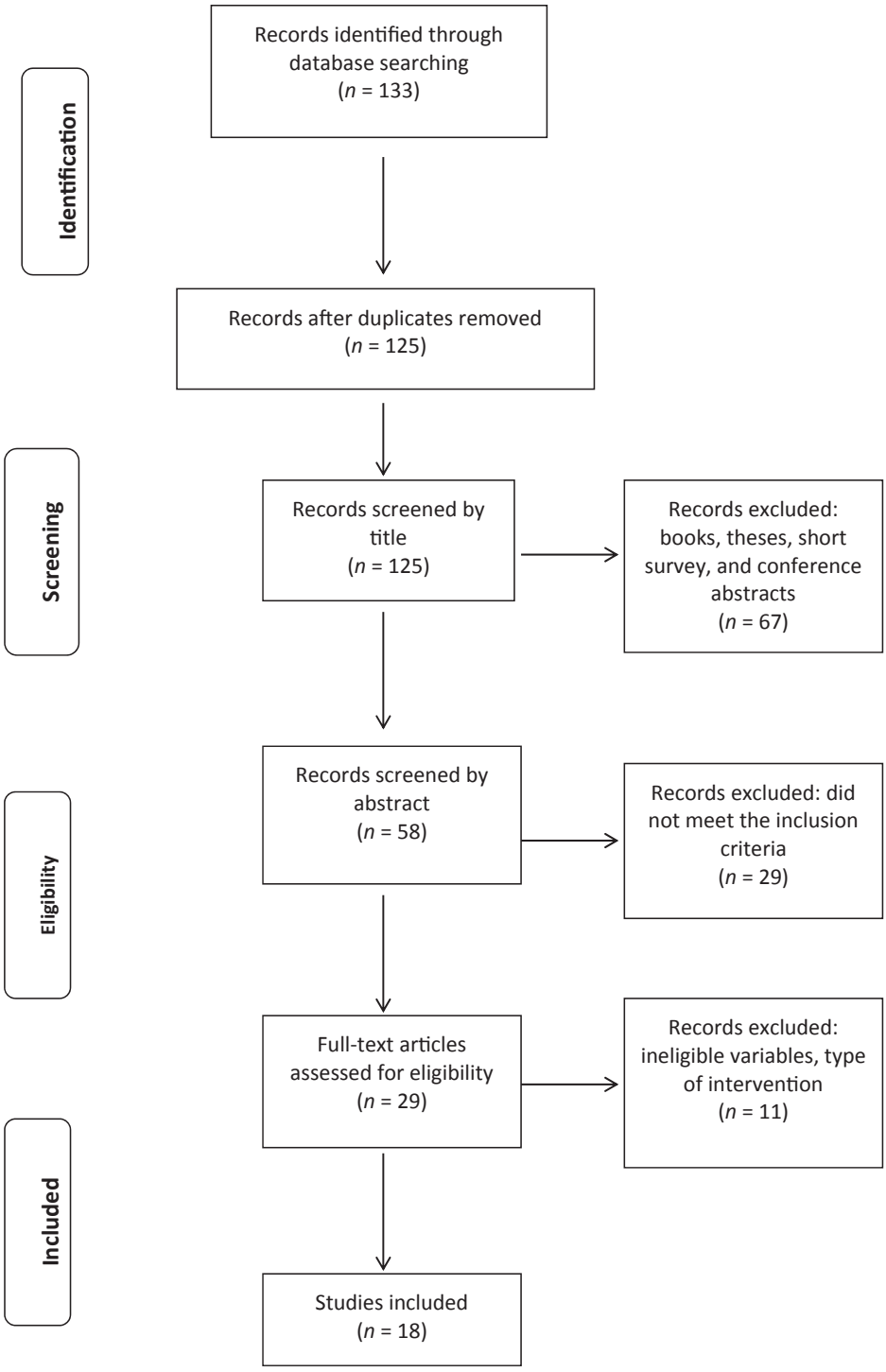

Figure 1. Search strategy based on PRISMA flow diagram.

female, clinically diagnosed with idiopathic PD, and Stage 1–4 of the Modified Hoehn and Yahr scale[17].

2.2. Study selection

Studies selected for this systematic review were identified through a detailed search of online databases related to physiotherapy, health and rehabilitation such as CINHAL (1982–2014), Medline (1922–2015), Scopus (1996–2015), Web of Science (2002–2015), Embase (2007–2015), PEDro (1999–2015), and The Cochrane Library (1996–2015). The search was conducted in September 2015 using the following key words: *Parkinson's disease*, *Parkinson**, *Parkinsonism*, *dance*, *dance therapy*, *dance genres*, *safety*, *feasibility*, and *quality of life*.

2.3. Data extraction and quality assessment

Duplicates were removed and titles and abstracts were assessed by the main reviewer. Two independent investigators (L.P.A. and P.A.d.R.) completed full text assessments by filling out a detailed

Table 1
Summary of characteristics of included studies.

Study	Participants	Age (y), mean ± SD	Sex M/F (%)	Disease duration (y), mean ± SD	H&Y mean ± SD or range	Intervention	Therapy frequency	Duration of intervention	Session length (min)	Therapy intensity
Westheimer 2015 (CS)[35]	Total: 12	66.2 ± 7.3	50/50	ND	2.3 ± 0.8	Contemporary dance	2/wk	8 wk	75	ND
Shanahan 2015 (CS)[21]	Total: 10	66.66 ± 5.87	70/30	7.3 ± 5.96	1.5 ± 0.5	Irish set dancing	1/wk	8 wk	90	ND
Romenets 2015 (RCT)[27]	Total: 33						2/wk	12 wk	60	ND
	18	63.2 ± 9.9	57/43	5.5 ± 4.4	1–3	Argentine tango				
	15	64.3 ± 8.1		7.7 ± 4.6		Control				
Hashimoto 2015 (Quasi-RCT)[28]	Total: 46		58/42	ND			1/wk	12 wk	60	Comfortable pace
	15	67.9 ± 7.0			2.7 ± 0.4	Modern dance				
	17	62.7 ± 14.9			2.7 ± 0.5	Exercise				
	14	69.7 ± 4.0			3 ± 0.5	Control				
Blandy 2015 (CS)[29]	Total: 6	64 ± 6.28	50/50	8.57 ± 4.0	2	Argentine tango	2/wk	4 wk	60	ND
Houston 2015 (CS) [37]	Total: 6	ND	50/50	ND	ND	Ballet	1/wk	12 wk	75	ND
Duncan 2014 (RCT)[25]	Total: 10		80/20				2/wk	24 mo	60	ND
	5	69.6 ± 6.6		6.6 ± 7.5	2.4 ± 0.4	Argentine tango				
	5	66 ± 11.0		11 ± 3.9	2.3 ± 0.2	Control				
Volpe 2013 (RCT)[11]	Total: 24		54/46				1/wk	6 mo	90	ND
	12	61.6 ± 4.5		9.0 ± 3.6	2.2 ± 0.4	Irish set dancing				
	12	65.0 ± 5.3		8.9 ± 2.5	2.2 ± 0.4	Standard care				
McKee 2013 (CS)[34]	Total: 33		60/40					12 wk	60	ND
	24	68.4 ± 7.5		7 ± 5.5	2.3 (2,2.6) [a]	Tango	20			
	9	74.4 ± 6.5		7.2 ± 4.9	2 (2.0,2.0) [a]	Education	20			
Foster 2013 (RCT)[26]	Total: 62		57/43				2/wk	12 mo	60	ND
	26	69.3 ± 5.4		5.8 ± 5.4	2.5 ± 0.5	Argentine tango				
	26	69.0 ± 7.8		7.0 ± 4.8	2.4 ± 0.4	Control				
Duncan 2012 (RCT)[24]	Total: 52		57/43				2/wk	12 mo	60	Low aerobic effort
	26	69 ± 1.9		5.8 ± 1.1	2.6 ± 0.1	Tango				
	26	69 ± 1.5		7.0 ± 1.0	2.5 ± 0.1	Control				
Heiberger 2011 (CS)[31]	Total: 11	71.3 ± 8.4	45/55	9.1 ± 4.6	1–4	Contemporary Dance	1/wk	8 mo	75	ND
Marchant 2010 (CS)[32]	Total: 11	71.2 ± 6.1	36/64	9.0 ± 5.5	2.4 ± 0.4	Improvisation	10 in 2wk	2 wk	90	ND
Hackney 2010 (RCT)[16]	Total: 39		71/29				2/wk	10 wk	60	ND
	19	69 ± 8.5		9.5 ± 5.3	2.5 ± 2.3	Tango partnered				
	20	69.6 ± 9.5		7.9 ± 4.7	2 ± 2.26	Tango nonpartnered				
Batson 2010 (CS)[33]	Total: 11	72.7 ± 8.7	55/45	1–6	1–2.5	Modern Dance	3/wk	3 wk	85	Low aerobic effort
Hackney 2009 (RCT)[13]	Total: 75						2/wk	13 wk	60	ND
	14	68.2 ± 1.4		6.9 ± 1.3	2.1 ± 0.1	Tango				
	17	66.8 ± 2.4	73/27	9.2 ± 1.5	2 ± 0.2	Waltz, foxtrot				
	13	64.9 ± 2.3		8.7 ± 1.3	2 ± 0.1	Tai Chi				
	17	66.5 ± 2.8		5.9 ± 1.0	2.2 ± 0.2	Control				
Hackney 2009 (CS)[30]	Total: 14	67.2 ± 9.6	57/43	9.1 ± 4.6	2.4 ± ND	Tango	5/wk	2 wk	90	ND
Hackney 2009 (RCT)[22]	Total: 58		70/30				2/wk	20 wk	60	ND
	14	68.2 ± 1.4		6.9 ± 1.3	2.1 ± 0.1	Tango				
	17	66.8 ± 2.4		9.2 ± 1.5	2 ± 0.2	Waltz, foxtrot				
	17	66.5 ± 2.8		5.9 ± 1.0	2.2 ± 0.2	Control				
Hackney 2007 (RCT)[23]	Total: 19		63/47				2/wk	13 wk	60	ND
	9	72.6 ± 2.2		6.2 ± 1.5	2.3 ± 1.5	Tango				
	10	69.6 ± 2.1		3.3 ± 0.5	2.2 ± 0.5	Exercise				

CS = case series; H&Y = Hoehn and Yahr scale; ND = not described, NS = not specified; RCT = randomized control trial; SD = standard deviation.
[a] Median (first, third quartiles).

data extraction sheet. Limitations, attrition, adherence, adverse events, and side effects of the studies were taken into consideration.

We categorized the different study designs and synthesized the literature, allowing comparisons both between and within groups[18]. We used the Downs and Black checklist[19] for non-RCTs and case series studies and the PEDro[20] scale for RCTs.

2.4. Therapeutic outcomes

Outcomes were chosen in order to evaluate the effects of therapeutic dancing on walking performance, freezing of gait, mobility, balance, quality of life, and disease severity.

2.5. Data synthesis

Summary data were produced in relation to the sample demographics, means, medians, and standard deviations for the assessed outcomes.

3. Results

Following screening, 19 studies met the inclusion criteria including nine RCTs[13,16,21–27], one quasi-RCT[28], and nine case series[21,29–37] (Figure 1). Table 1 describes the characteristics of participants and interventions.

Assessment tools and results used for the dancing studies are reported in Tables 2 and 3.

Table 2
Outcomes measures and changes for randomized control trials.

Study	Outcomes (measurement tool)							Results	
	Adverse events	Adherence	Attrition	Quality of life	Balance	Motor performance (gait/endurance)	Mobility/ disease severity	Variables	Absolute change
Volpe 2013 (RCT)[11]	No	—	—	PDQ-39	BBS	FOG-Q	TUG UPDRS III	Irish set dance	
								Mobility	Improved (DNS)*
								Balance	Improved (10)
								Disease severity	Improved (7.16)*
								Freezing of gait	Improved (6.5)*
								QOL	Improved (8.44)*
								Physiotherapy	
								Mobility	Improved (DNS)
								Balance	Improved (4.84)
								Disease severity	Improved (2.92)
								Freezing of gait	Improved (0.59)
								QOL	Improved (4.97)
Foster 2013 (RCT)[36]	ND	ND	Tango: 19%	—	—	—	UPDRS I, III	Tango	
								Activity participation	Improved (DNS)*
								New activities	Improved 0.5 (1.0)*
			Control: 13%					Control	
								Activity participation	NC
								New activities	Improved 0.15 (0.48)
Duncan 2012 (RCT)[24]	ND	78%	Tango: 50%	—	Mini-BESTest	6MWT	MDS-UPDRS	Tango	
						FOG-Q	I, III	FOG	DNS
						GAITRite	PASE	Walking distance	NC
								Walking speed	Improved (DNS)*
								Balance	Improved (DNS)*
								Disease severity	Improved (12.8)*
			Control: 37%					Control	
								FOG	Declined (DNS)*
								Walking distance	Declined (DNS)*
								Walking speed	NC
								Balance	Declined (DNS)
								Disease severity	NC
Hackney 2010 (RCT)[16]	Yes: fatigue	ND	0%		BBS	6MWT	UPDRS III	Tango partnered	
					1 leg stance	GAITRite	TUG	Balance	Improved (3.2)*
								Walking distance	DNS
								Walking speed	Improved (5 m/s)*
								Mobility	Improved (0.4)
								Tango nonpartnered	
								Balance	Improved (2.6 points)*
								Walking distance	DNS
								Walking speed	Improved (4 m/s)*
								Mobility	Declined (0.1)
Hackney 2009 (RCT)[22]	Yes: pain	80%	Tango: 26%	—	BBS	6MWT	TUG	Tango	
						FOG-Q	UPDRS III	Disease severity	Improved (1.6)
						GAITRite		Balance	Improved (6)*
								Mobility	Improved (2.1)
								Walking distance	Improved (59.4 m)*
								Walking Speed	Improved (0.08 m/s)
								FOG	Improved (0.9)
			Waltz and Foxtrot:15%					Waltz and foxtrot	
								Disease severity	Improved (2.6)
								Balance	Improved (6.1)*
								Mobility	Improved (0.1)
								Walking distance	Improved (49.1 m)*
								Walking speed	Improved (0.02 m/s)
								FOG	Improved (0.1)
			Control: 11%					Control	
								Disease severity	Declined (5)
								Balance	Improved (1.2)
								Mobility	Declined (2)
								Walking distance	Declined (8.5 m)
								Walking speed	Improved (0.02 m/s)
								FOG	Declined (1.2)
Hackney 2009 (RCT)[13]	Yes: Knee pain	—	Tango: 26%	PDQ-39	—	—	UPDRS III	Tango	
								PDQ-39	Improved (7.01)*
			Waltz: 11%					Waltz and foxtrot	
								PDQ-39	Improved (0.68)
			Tai Chi: 24%					Tai Chi	
								PDQ-39	Declined (1.55)
			Control: 15%					Control	
								PDQ-39	Improved (1.5)

(*continued on next page*)

Table 2 (*continued*)

Study	Outcomes (measurement tool)							Results	
	Adverse events	Adherence	Attrition	Quality of life	Balance	Motor performance (gait/endurance)	Mobility/ disease severity	Variables	Absolute change
Hackney 2007 (RCT)[23]	ND	ND	0%	—	BBS	FOG-Q Walking speed (5 m path)	UPDRS III TUG	Tango Disease severity Balance FOG Walking speed Exercise Disease severity Balance FOG Walking speed	 Improved (8)* Improved (3.8)* Improved (1) Improved (2 m/s) Improved (7.6)* Improved (1.7) Improved (1.4) Improved (2 m/s)

* $p < 0.05$.
6MWT = Six-Minute Walk Test; ABC = the activity of balance confidence questionnaire; BBS = Berg Balance Scale; FOG-Q = Freezing of Gait questionnaire; NC = no change; ND = not described; PASE = Physical Activity Scale for Elderly; PDQ-39 = Parkinson's disease questionnaire 39; QOL = quality of life; TUG = Timed Up and Go Test; UPDRS = Unified Parkinson's Disease Rating Scale.

Table 3
Outcomes measures and changes for nonrandomized control trial studies.

Study	Outcomes (measurement tool)							Results	
	Adverse events	Adherence	Attrition	Quality of life	Balance	Motor performance (gait/endurance)	Mobility / disease severity	Variables	Absolute change
Westheimer 2015 (CS)[35]	No	ND	14%	PDQ39	BBS	UPDRS - III	UPDRS III	DfPD Disease severity Gait Balance QOL	 Improved (3)* Improved (0.4)* Improved (0.2) Improved (0.2)
Shanahan 2015 (CS)[21]	None	86%	ND	PDQ39	BBS	6MWT	UPDRS III	Irish Set Dancing Disease severity Walking distance Balance QOL	 Improved (2) NC Improved (1) Improved (4.07)*
Hashimoto 2015 (Quasi-RCT)[28]	ND	ND	ND	—	BBS	—	UPDRS TUG	Modern Dance Mobility Balance Disease severity Exercise Mobility Balance Disease severity Control Mobility Balance Disease severity	 Improved (1.9) Improved (4)* Improved (19.6)* Improved (1.1) Improved (0.2) Improved (0.9) Improved (0.9) NC Declined (4.1)*
Blandy 2015 (CS)[29]	Minor related to comorbidities	89%	17%	Euroqol5D	—	—	MDS UPDRS III	Argentine Tango QOL	 Improved (0.94)
Houston 2015 (CS)[37]	ND	100%	ND	—	FAB	—	—	Ballet Balance	 Improved (4)*
McKee 2013 (CS)[34]	Tango: 2 falls Education:	_	Tango: 0% Education: 11%	PDQ39	FAB Four square step test	FOG-Q	UPDRS III TUG	Tango Disease severity Mobility Balance QOL FOG Education	 Improved (4.1)* Declined (0.02) Improved (2.6) Declined (0.2) Improved (0.7)

Table 3 (*continued*)

Study	Outcomes (measurement tool)							Results	
	Adverse events	Adherence	Attrition	Quality of life	Balance	Motor performance (gait/endurance)	Mobility / disease severity	Variables	Absolute change
	None							Disease severity	Declined (2.1)*
								Mobility	Declined (1pt)
								Balance	Improved (1.2)
								QOL	Improved (0.6)
								FOG	Improved (1.4)
Heiberger 2011 (CS)[31]	ND	ND	ND	Modified Westheimer QOLS	Semi-tandem test	—	TUG UPDRS III	Dance (MMDG)	
								Mobility	Improved (0.7)
								Disease severity	Improved (8.2)*
								Balance	Declined (1.6)
								QOL	Improved (DNS)
Marchant 2010 (CS)[32]	ND	ND	0%	PDQ39	BBS ABC	6MWT FOG-Q GAITRite	UPDRS III TUG Five times Sit-to-Stand test	Contact improvisation dance	
								Disease severity	Improved (5.4)*
								Balance	Improved (3)*
								Mobility	Improved (0.5)*
								Walking speed	NC
								Walking distance	Improved (3.8 m)
								Tango	
								Disease severity	Improved (4.6)*
								Balance	Improved (2.8)*
								Mobility	Improved (2)
								Walking speed	DNS
								Walking distance	Improved (35.8 m)
Batson 2010 (Single Group)[33]	No	91%	0%	—	FAB	—	TUG	Modern dance	
								Mobility	Improved (9.1)
								Balance	Improved (3.1)*
Hackney 2009 (CS)[30]	ND	ND	14%	—	BBS	6MWT GAITrite	TUG UPDRS III	Tango	
								Disease severity	Improved (4.6)*
								Mobility	Improved (2)
								Balance	Improved (2.8)*
								Walking speed	Improved (0.1 m/s)
								Walking distance	Improved (35.9 m)

*$p < 0.05$;
BBS = Berg Balance Scale; DfPD = Dance for Parkinson's Disease; FAB = Fullerton Advanced Balance Scale; FoG = freezing of gait; FoG-Q = Freezing of Gait Questionnaire; MDS = Movement Disorder Society; MMDG = Mark Morris Dance Group; MWT = Metres walking test; ND = not described; PDQ39 = Parkinson's disease questionnaire 39; QOL = quality of life; SD = standard deviation; TUG = Timed Up and Go test: UPDRS = Unified Parkinson's Disease Rating Scale.

Of the nine RCTs[13,17,22–28] appraised, six scored 8/10 on the PEDro scale[8,11,16,24,25,27]. One scored 7[26], and three scored 6[13,22,23]. All non-RCTs showed fair levels of methodological quality.

Most studies showed that dance therapy was enjoyed by the participants. Seven reported that individuals with PD were compliant with the intervention and willing to keep attending[16,21–24,30,32]. There was generally high adherence, ranging from 78%[33] to 91%[34].

4. Discussion

The weight of the evidence suggests that therapeutic dancing can be beneficial for improving motor performance[22,24,30,31], mobility[11,27,28], and balance[16,21–25,27,28,30,32,34,37] in people with PD[11,31,35]. Dancing can also have a positive impact on quality of life[1,13,21] and adherence to physical activity over the long term[26]. Dancing was associated with short-term improvements in freezing of gait, walking performance and wellbeing in some individuals[7,11,16,22,23]. Although a number of studies reported data for participant adherence[21,22,24,29,33,37], attrition[13,22,24,26,29,30,34,35], and adverse events[13,16,22,27,29,34], more research is needed to understand these aspects of dancing programs.

Little was documented on the effects of partnered versus non-partnered dancing even though Hackney and Earhart found that partnered dancing is associated with greater levels of compliance and more optimal outcomes all[16]. Also under-researched was the use of different dance genres in mixed dancing classes[28], efficacious scheduling of therapy, the optimal frequency of dance classes, the effects of different music genres, participant satisfaction with therapy, socialization, and the extent to which there was retention of improvements associated with different types of dance. For example, Beevers et al[15] showed that music is a powerful determinant of motor performance in people with PD, especially when loud rhythmical tempos are used that provide external cueing to the defective basal ganglia pathways. There was notable lack of information about the advantages of caregiver participation, which may be associated with more optimal participant compliance.

In regards to limitations, this review showed generally small sample sizes, restricting the generalizability of findings to people in the early stages of PD. None of the projects had large samples. Only

a small variety of dance genres were evaluated. The review did not reveal the underling motor control mechanisms associated with dance related gains. Nevertheless, a recent article by Dhami et al[36] hypothesized that rhythmical music used in dancing classes could activate neurons serving motor control and increase blood flow in regions such as the hippocampus and, frontal, temporal, and parietal cortices. This could facilitate neuroplasticity and in turn improve movement, balance, and cognition.

To conclude, therapeutic dancing was found to be feasible, safe, and enjoyable. Compared with routine exercises, it may well afford greater adherence, compliance, and enjoyment whilst not compromising safety, especially in the early stages of disease progression. Further studies should be directed towards understanding the relative contribution of music to dance outcomes as well as comparing the outcomes of different dance genres. A multidisciplinary approach to team management also appears optimal[38].

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